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Report AMCA-70-011

MANAGEMENT INFORMATION SYSTEM REQUIREMENTS FOR 1990's COMBAT SERVICE SUPPORT

Report of the Eleventh Ad Hoc Working Group

June 1970

U.S. ARMY
ADVANCED MATERIEL CONCEPTS AGENCY

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US Army Advanced Materiel Concepts Agency
Exploratory Evaluation Division
Washington, D. C. 20315

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ABSTRACT

The US Army Advanced Materiel Concepts Agency (AMCA) convened an ad hoc working group (AHWG) for three days (27-29 January 1970) to identify information-system requirements for a combat-service-support management control center for the 1990's. This AHWG contributed to an ongoing study that will culminate in the conceptual design of a transportable control center for theater-level management of combat service support. The AHWG developed a generalized description of the combat-service-support system for the 1990's. The group assumed that there would be no equipment constraints in the 1990's to collection, storage, retrieval, and analysis of vast quantities of data. The group agreed that the theater commander must be given the capability of probing into data to any depth he might desire, but that the major command-and-control needs of the commander could be satisfied by display of evaluations of logistics policies, plans versus operations, and indicators of operational effectiveness. The major information requirement is to provide resource visibility; the information system must be self checking, and, when feasible, self correcting; policies, plans, and programs should be entered into the automated information system (duplicated in CONUS and the theater), updated as situations change, and continuously compared with ongoing operations; and the information system should include a computer model of the combat-service-support system, providing a simulation capability.

PREFACE

This report presents the findings of an ad hoc working group comprised of individuals from many organizations and convened for just three days. The reader of this report should understand the nature of such a group. The group was encouraged to think creatively and not be bound by preconceived ideas or be inhibited by the normal organizational pressures for conformity and command approval. The ideas contained in this report are, therefore, the ideas of individuals as affected by the interactions within the group. These ideas do not have the sanction (nor do they require it) of parent agencies. Even AMCA, while proud of the creative atmosphere it has provided, does not accept this report as a statement of agency-approved policy. The report is what it purports to be, the faithful reproduction of ideas as presented by the conferees.

AMCA would like to acknowledge the outstanding contribution of each member of the ad hoc working group. AMCA is particularly grateful for the quality of leadership, the dedication, and the breadth of knowledge demonstrated by the three panel chairman: Mr. Joseph Smith, CDC Supply Agency; Mr. Kenneth Bopp, CDC Personnel and Administrative Services Agency; and Mr. Athol George, Army Logistics Management Center. Also, AMCA would like to express its appreciation for the creative and helpful efforts of Mr. Charles Reiss, Peat, Marwick, Mitchell & Co., in assisting in preparation of the guidance for the AHWG, and to Mr. Albert L. Fullerton, Sanders Associates, in editing and revising this report. Both gentlemen also provided invaluable contributions as working members of the AHWG.

This report was prepared by Mr. Howard J. Vandersluis, Exploratory Evaluation Division, AMCA, the chairman of the AHWG.

AMCA AD HOC WORKING GROUPS COMPLETED AND IN-PROCESS

AHWG Number	
1	Future Warfare in Urban Areas
2	Adverse Effects of Slopes on Military Operations
3	Directed Energy for Military Operations
4	Automated Intelligence for the Tactical Army 1980/1990
5	Low Frequency Shielding
6	Aerial Very Heavy Lift Concepts for the 1990 Army
7	High Intensity Tactical Power Sources for the 1990 Army
8	Application of Automation to Fire Support Process, LCS-90
9	Ground Effect Vehicles
10	Mechanized/Automated Stock Handling for the 1990 Field and Theater Armies
11	Management Information System Requirements for 1990's Combat Service Support
12	Remote Atmospheric Sensing
13	Analytical Techniques for Logistics Management
14	Tentatively Assigned to Applications of Artificial Intelligence for the Future Army
15	Navigation and Position Location for the 1990 Army
16	Mobile/Portable Ports 1990
17	The Man-Machine Interface for 1990 MIS Displays

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SECTION I

INTRODUCTION

1. The Problem

The Advanced Materiel Concepts Agency (AMCA) is engaged in a study, the outcome of which will be the conceptual design of a portable management control center for combat service support for the Army in the field. This study is focused on the theater army commander's level of responsibility for service support.

In order to proceed with considerations of devices to be incorporated in the control center, it was first necessary to examine the service-support information requirements for the commander at the theater army level. The ad hoc working group study described in this report had the objective of examining these information requirements and describing them, to the extent feasible, in terms of types, quantities, characteristics, and timeliness factors.

The ad hoc working group was instructed that they were to consider information requirements from the point of view of "indicators of management effectiveness" rather than from a concept of manipulation of a total data base. To elaborate, it is conceivable that by 1990 all data generated in the theater may be stored in such a way that it could be retrieved on an immediate-access basis from any point in the system authorized to retrieve the data. With the speed and power postulated for 1990 computers, this total-data base could be manipulated to meet any conceivable information needs. However, this approach greatly expands the scope of the control-center study that we are performing. We therefore intended to restrict our study to the manipulation, and computer-associated display, of sampled management information (indicators of management effectiveness). Nevertheless, as will be seen in the following report, the ad hoc working group agreed on the need for a total-data base.

2. Background Information

The overall program, the conceptual design of a transportable control center for combat service support, will fill a recognized gap in army capabilities for management of combat service support. Commanders at all levels frequently express concern and frustration over the difficulties of identification of service-support problems in time to take corrective action. In response to this concern, logistics control centers are evolving in commands throughout the world. These centers employ charts and other simple display devices, though even the current technology is capable of providing management-control systems with far greater utility. Consider, for example, the fire-

control centers in use in the Army and the tactical-aircraft control centers provided the Air Force. Both employ sophisticated computers and electronic displays whereas the logistics control centers rely primarily on wall charts, grease pencils, and computer printouts.

In an era (1990 - 2000) when there may be technological parity and numerical superiority on the part of the enemy, it is essential that we exploit any marginal capability we may have. A system that places the right personnel and equipment at the right place at the right time will be of crucial significance since we may win only by making more efficient use of our resources than the enemy does.

Predictions of the combat environment for the 1985-1995 time frame emphasize small-unit actions and confused-battle conditions. Tactical units must be highly mobile and capable of operating independantly of their bases for several days at a time. In the event of nuclear warfare, catastrophic conditions may become commonplace. Under this postulated combat environment, there will be a necessity for real-time coordination and control of all service-support activities in order to assure continuous support.

As viewed conceptually, the combat-service-support control center will comprise communication devices, data storage capabilities, a computer with required software, information-display devices, and a directive capability. The communications capabilities will include provisions for interchange of information between the commander and subordinate commanders, including authorized queries by subordinate commands to the data system. The system storage capability will provide for retention of data that must be maintained on file for evaluation of incoming data*. The computer will be sufficiently powerful to provide for problem solving, display generation, and a reasonable amount of simulation. (More extensive requirements will be handled by the larger computers used in operational facilities.) The outputs of the analyses may be displayed both automatically and selectively. The display devices may facilitate directive action by permitting commanders to influence operations by simply manipulating displays. All of these devices may be contained in one or more prefabricated air-transportable facilities (e.g., 8' x 8' x 40' transmodal containers) provided with environmental control devices and appropriate CBR protection. The control center, complete with all systems, will be designed for delivery to the theater of operations in a ready-to-function condition.

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* The data retained will include that necessary for the construction of cross-reference files, management controls, and error-detection routines. The process cannot be totally open-ended; there must exist doctrine for file purging based on age, utility, accuracy, etc.

3. AMCA Study Approach

The AMCA study approach comprises a literature search, in-house analysis, interviews, ad hoc working groups, and, possibly, limited contractual assistance. The purpose of the AMCA ad hoc working groups is to assemble, for short periods of time, individuals who have broad backgrounds in the field of interest and demonstrated creative ability so that they may express their ideas in interaction with others of the group. There are four ad hoc working groups planned for this study. The first two are intended to examine the working parameters for the equipment system. The last two will consider the technological potential for an optimum equipment system for incorporation in the control centers. This report covers the first of the planned series of ad hoc working groups.

4. Description of This Ad Hoc Working Group

The members of the ad hoc working group whose findings are described in this report were selected from Government organizations, industry, and an educational institution. Five are from Combat Developments Command agencies (a necessarily high representation because of the doctrinal nature of this phase of the study). Two individuals represented equipment manufacturers. Two are management consultants. One is the Chairman of a university information science department. One individual was from the Office of Naval Research, and the balance of the 18-man ad hoc working group was from various Army agencies including AMCA. (A list of participants is contained in appendix A.)

The first day of the three day session was used for presentations made by certain of the participants. (Summaries of these presentations are contained in appendix B.) The purposes of the presentations were to establish a common frame of reference for the participants and to inspire them to creative thinking.

At the end of the first day, the group was divided into three panels. Each panel was to consider the overall problem from a specified point of view. Panel I took the point of view of materiel, maintenance, transportation, base development and construction, facilities operation and maintenance, and lines of communication. Panel II took the point of view of personnel, personnel oriented logistics, and administration. Panel III took the point of view of the overall command and systems considerations including coordination and interfacing with other services, other nations, and CONUS.

On the second day and on the morning of the third day, the panels met separately for discussion. The afternoon of the second day and the morning of the third day the panels prepared their presentations,

following the general outline of: understanding of the problem; approach; discussion; and conclusions. The morning of the third day, during the final preparation for the presentations, there was a member present in each panel room from each of the other panels to critique the presentations and assure coordination of ideas.

The afternoon of the third day, each panel presented its findings before the entire group. These presentations and the ensuing discussions form the basis for the balance of this report.

SECTION II

DISCUSSION OF THE PROBLEM

1. Introduction

This section describes the understanding of the problem as expressed by each of the panels. The panels did not appear troubled by the definition of the problem as presented; however, they found it necessary to discuss the functions of service support at some length before they reached a mutually agreeable description of the management problem.

2. Panel Approaches

Panel I first attempted to establish assumptions, guidelines, and characteristics for the functional areas assigned. Based on these they formulated a management control system. They were looking particularly at interrelationships of functional systems. They then developed an approach to measuring the effectiveness of these functional systems so that an executive could determine whether he was on target, about to get into trouble, or that there were other problems he should address.

Panel II considered the problem from the point of view of data impacting on the theater policy-making and planning functions.

Panel III stated that their specific problem was to consider data requirements in those areas encompassing the service support system as a whole, focusing on general command and systems factors rather than on service support functional components. The panel first reviewed the elements of the logistical system. Using the materiel system as a basis, the group discussed the flow of assets from the source to the user, and the echelons and agencies now involved in that flow. They reviewed the data which would be required at each of the echelons in order to make the system function. They then discussed the organization of the theater support command as envisioned for the 1990's, and the control elements and action elements involved in that organization. This was compared with the organization for support in Vietnam, and the conclusion was reached that no matter how you look at the system, in whatever time frame, you come back again to the realization that you must have a system that will move things from where they are produced to where they are needed. You may shorten it, you may lengthen it, you may put things in, you may take things out, but you still must have some means of getting things to the point where you need them.

SECTION III

ASSUMPTIONS AND ENVIRONMENTAL CONSIDERATIONS

1. Introduction

From this point on in the report, panel findings have been consolidated for ease of comprehension. This was made possible by the fact that there were no fundamental disagreements between panels. It should also be noted that the term "assumption" is used in a broader sense than normally found in staff studies. The term "prediction" could be substituted for assumption in most instances.

2. Assumptions Related to the Overall System

A theater on foreign soil, with an ocean separating the theater from CONUS, was the generalized environment selected for discussion because this condition was felt to represent the most complex situation to arise. Further, the combat environment was assumed to be highly fluid with great combat-unit mobility. There will be stocks located outside the theater but under theater control. The theater commander will have the authority to have these assets moved. However, the National Inventory Control Point in CONUS will have full visibility of the stocks under theater control*, including all assets in the theater.

The management information system assumed for these discussions will be a dual system in which most data in theater computers will be duplicated in CONUS computers. CONUS computers, in turn, will provide theater computers with pertinent data from CONUS. Policies, plans, programs, and other top level guidance will be interrelated world wide in the CONUS computers with a provision for breaking out the theater related portions. Changes in plans or asset positions will be analyzed against this duplicate data base, in CONUS and the theater. Any impact will be portrayed at either or both ends. The hardware will be capable of performing all of the administrative functions required of the system. And the software will be available (or, if specialized or individualized requirements, may be generated) for the particular purposes of evaluating effectiveness as well as for normal operational purposes.

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* The term, "control," may be a misnomer since the management system from CONUS to and within a theater must be viewed as a unified system.

There will be a dedicated computer and associated communications capability for logistics. This was considered very important because if logistics and tactics are on the same computer and communication network, logistics will get what is left.

There will be a theater logistics control center, either in the theater or, possibly, in the air, afloat, or under water outside the theater; but wherever it is, it will be under theater control*.

There will be a high reliance on air movement; but it was also assumed that much cargo would still continue to be moved by surface means in the 1990 time frame.

All panels made the assumption that there will be no equipment constraints, that whatever is needed to operate the proposed management information system can be made available. This will include back-up equipment. The management information system will be sufficiently flexible so that it will be highly responsive to the needs and modes of command of any specific commander. Programs will be generated or adapted by straightforward, easily-learned techniques; and displays will be formatted and manipulated automatically at the will of the commander.

3. Assumptions Related to Supply

There will be little or no prepositioning of supplies in the theaters in the 1990's. Reliance for supply must be based on the concept of "inventory in motion." Assets will be visible wherever they may be in the system: coming off the production line, on a train, in a depot, in the air, on a freighter, or (for selected items) in the hands of the troops. This visibility will be maintained by NICP's and a theater-oriented control center. Asset visibility will include resources available locally or captured from the enemy.

Repair of equipment in the field will be minimized. Where repair in the field is necessary, it will be accomplished by component replacement. The determination of what is repairable must be based on an evaluation of: costs of procurement and shipment of a replacement, utilization of critical skills and materials, and combat essentiality of items.

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* One AHWG member took exception to the statement that the control center will be under theater control, feeling that if the system is designed around this premise and the premise fails (e.g., control is exercised from CONUS), the system will fail.

There will be an increased use of commercial equipment. There is quite a bit of commercial equipment in use in the Army already, and this is only the beginning. There are many fields in which industry can provide the Army virtually what is needed. Industry might then provide part or even all of the direct support for that equipment.

4. Assumptions Related to Transportation

Movements management will be centralized at the theater level to include transportation resources of all services. This centralization may even include the resources of allied governments operating within the theater. Decisions that can be made by a central headquarters will not be made in the field.

Some twenty percent by weight of supplies shipped to the theater will go by air. Implications of this change will be that transfer, identification, checking, and clearing of cargo at air terminals must be completely automated in order for theater forces to cope with the volume of movement. Most materiel arriving at an inter-theater debarkation point will be moved forward into the theater by air lift.

In the next twenty years the vast majority of available sea lift will be in the form of container ships not having the capability for self-loading and unloading. Self-deployable container terminals comprised of cranes, conveyors, modularized storage racks, and heavy-lift VTOL facilities will be required.

All modes of transportation available today will be used in the 1990's, but new equipment and techniques will have been introduced. Floating supply and maintenance bases may be used. Ships may be discharged and loaded by helicopter, bypassing shoreline terminals. Intransit storage of materiel in containers will be by means of automated facilities, essentially skeleton-type multi-story warehouses. Containers will move into and out of such facilities by electro-mechanical means; control will be by switchboard. The movements management authority itself may be ship-based, so as to avoid the need for shore side construction. Inland waterway transport, and some land transport may be by means of air-cushioned vehicles.

5. Assumptions Related to Construction

There will be considerable use of prefabricated and pre-engineered modular facilities. Many of the facilities will be in the form of pods and vans. If facilities must be assembled in the field they will be put together like Erector Sets. Hard surfaces will be required, such as air fields, roads, and hardstands for storage; but other permanent-type construction will be minimized in the theaters.

The project approach will be used in the supply of construction materials. Construction materials will be issued on the basis of approved projects. These materials will be delivered to the construction site in coordination with the construction program using management techniques similar to those used by industry and commercial construction. There will be an interface between theater and CONUS construction management automatic data processing programs.

Contractor support will be provided in the theater. Whether construction is by military engineers or by contractors, maximum use will be made of the Engineer Functional Components System for planning, supply, design, and construction. New design, if necessary, will be simple, flexible, and provide for multi-purpose use and future expansion of the completed work. The permanency of any structure or facility erected will be only that consistent with military necessity at the time. Existing available or modified facilities will be used before initiating new construction. Large projects will be staged to allow use of completed elements while construction continues on the remainder. Installation plans will be of such a nature as to avoid creating lucrative area targets.

6. Assumptions Related to Personnel

The functions of centralized control and maintenance of data will reside in an expanded data base in CONUS. This will produce an inverted pyramid of data that gradually diminishes from the top to the bottom to provide data at each echelon of command consistent with the delegation of authority for personnel-management functions. Personnel replacements will be accomplished by individuals, functional modules, or units. A theater rotation policy will be established. All personnel movements will be by air. Theater training requirements will be limited to those necessary for acclimatization and indoctrination. Hospital care in the theater will be minimized. Maximum use will be made of off-shore or CONUS hospitals.

Morale facilities (e.g., PX, USO, etc.) will be required. Troops will be fed a ration comparable to the present 28-day menu. However, certain morale-support functions such as mail services may change radically.

To predict support requirements, greatly expanded personnel-related information will be available. For example, the management control system will know where each unit is operating, the type of operation, and the tactical posture it is in. The system will know which units are on the attack, defense, or in a supporting role.

SECTION IV

DESCRIPTION OF THE DATA SYSTEM

1. General Characteristics of the Data System

Predictions for computer capabilities, computer memories, and communications for the 1990 time frame indicate that there will be few technological limitations on the scope of the control that may be exercised by command and control systems. Computer memories will be fully capable of storing at one point (or several duplicated points) every item of data generated in the theater. All data will be stored in a random access configuration (similar to present magnetic-disc storage). Computers will be sufficiently powerful so that analyses may be performed on vast quantities of data without requiring sophisticated analytical or programing techniques. Communications systems, including satellite relay stations and broad-band channels, will remove most limitations on quantities of data transmitted and on the speed of transmission. (Limitations may still be imposed on the numbers of simultaneous video transmissions.)

In view of the above considerations, the members of the AHWG generally agreed that the principal problem to address was the one of assuring that all pertinent data* is accumulated in the system in a form in which it is available for analysis by the command and control system as well as for use in operations. The group visualized a system in which all data would be equally available in CONUS and the theater. Thus, management control, whether exercised in CONUS or in the theater, would operate from the same data base#. This data base would include policies,

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* "All pertinent data" is, perhaps too sweeping a term. Unfortunately, the pertinence of much data is something that is determined after the fact rather than before. How much data is saved because it might be needed or because it was needed on a previous occasion? Some risk must be accepted in what is thrown away. As mentioned previously, the data system cannot be totally open ended in data accumulation. A purge doctrine must be a part of the system.

\# The "data base" for combat-service-support control might more correctly be termed an "information base" since most of its content would consist of data analyzed and interpreted so that it becomes meaningful to a commander. The data base comprises: static data (e.g., tables, report formats), semi-static data (e.g., indices, cross-reference files, etc., subject to change, but not continuously) dynamic data (the raw data entering the system for analysis), control data (the dynamic instructions inserted by commanders), policy data, and information.

plans, programs, and other guidance information, all of which would be kept up to date simultaneously at all data storage points. Each commander would have the capability of calling for data, or placing data in, a central data bank, subject to specified restrictions. It should be noted here that with the vast quantities of data available it is essential that the information system be efficient. The commander must have all the information he needs but no more.

The data system will provide visibility of all assets in the system. "Assets," here, refers to all the resources available to the commander. They are equipment, supplies, people, and transportation capabilities. They are hospital beds, local-national labor, and facilities. The data system will tell the commander what resources he has, what condition they are in, where they are, and what commitments there are against them. The system will be self-checking so that the commander has assurance of a high level of data reliability.

The data system must be updated as changes occur; that is, the system should be constantly current. And, the commander should have immediate access to any data and not have to wait for a run or a report. Furthermore, the commander should have the capability to push a button and have answers to his questions displayed for him. Important information will be displayed automatically as the need arises, or warning devices will signal the need to examine specified conditions. If he wants to work with information he sees on his screen, he should be able to obtain hard copy from his terminal.

The combat service support data system will be tied in some fashion to the tactical data system. It will be necessary to have knowledge of campaign plans. What intensity of activity is anticipated? What units will be employed? What contingencies might require support? The combat service support data system must also follow operations, recording estimates of losses and analyzing consumption rates.

2. Policies, Plans, and Programs

Logistics policies applied to a specific theater can, in many instances, be expressed as standards, control limits, or goals. These policies should form the basis for plans and programs. What is wanted is clear statements containing percentages, levels, or other quantified measures. No system can be judged as to effectiveness if policies or standards have not been established as a basis for measurement. Logistics policies should be stored in immediate-access computer memories, both in CONUS and the theater, for use as a point of reference, a basis for change, and a basis for evaluation.

Plans and programs, governed by logistics policies, must be developed for each theater. A time-line technique such as a PERT network should be applied whenever practicable. Military operations normally call for a build-up, a plateau, and a draw-down. The characteristics of these should be portrayed over time. Available or planned assets should be reflected in the plans and programs. Once automated, plans and programs for a theater will be available both in CONUS and the theater. Through automation it will be possible to reflect changes in the plans and programs that occur at either end of the system.

3. Supply

Data requirements related to supply are of two types: those that pertain to the materiel under the direct control of the commander and those that pertain to materiel he is required to support. For the materiel under his control, he must know, as a minimum, what is on hand, where it is, what is on order, and what is due in. For the materiel that is due in, he should have the capability of following it in transit so that he knows precisely where it is at any time. In this way, he is able to exercise some control over materiel in transit, thus achieving one of the goals of the "inventory in motion" approach to supply management. For the materiel that the commander supports, he needs to know the unit equipment density, where items of equipment are within the command (by make or even serial number, if necessary), the condition of each item, the service life remaining, and any other information that might bear on tactical or strategic plans.

The unit authorization list (UAL) is a key technical-data requirement. Such a list will be developed for each organizational unit in the theater. It will include TOE number, unit title, unit code designator, unit location, strength, materiel by make, model, and quantity, mission-essential item codes, expendable supplies, consumption and replacement factors, and activity indicators that can be applied to consumption factors based upon anticipated operational situations. These data are required for effective support of unit readiness and for throughput supply shipments. The UAL provides the basis for a predictive model, is used throughout the system, and is the authorization for issue of materiel and supplies to units in the theater. The UAL will provide the basis for a capability to predict supply requirements, to schedule shipments, and to provide supply status.

4. Transportation

Movements management of all common user transport resources at theater level is essential. Theater movements management will be based on a computer system that contains complete data on the theater transport system and its capabilities. The status of the transport system

must be known to the theater manager on a real-time basis, and provisions must be made for a threshold warning system in case of actual or potential breakdowns and short falls. All movements will be programed centrally and performance will be measured against the movement program. If there are problems in any area they must be fed into the central agency and solved there. Any planning/programing decisions that can be made at the central headquarters must not be made in the field.* Continuous updating by field-agency inputs of the data available to the central agency will enable the central agency to remain constantly aware of any changes in the status of the system. Changes in the status occur because of enemy action, breakdown, movement of troops, changes in supply requirements, etc.

Increases in containerized cargo emphasized the need for rapid and reliable data handling. There must be accurate and dependable advance notice of arriving cargo. Equipment must be available for automatically identifying, checking, and documenting cargo (even when carried in containers). Routing must be automated and pre-programed, with consideration given to alternate routes in the event of enemy interdiction or unfavorable weather conditions.

5. Personnel

Personnel administration, for the purposes of this report, is the formalized administration process that supports individual personnel management decisions. The cumulative impact of such individual transactions is converted to numbers to become the basis for manpower-resource management. This manpower-resource data must be compatible with the management planning process within the theater. Primary data elements will frequently be derived from low or intermediate operating levels and may be unstructured (raw data) or accumulated in some type of report. He is concerned with people in terms of manpower resources.

The types and characteristics of data required for personnel management are all individual status changes, expressed in alpha-numeric form, used to compile the permanent chronological history of the individual's military service. As to quantities of data, the total cumulative

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* The intent of this statement is to emphasize that the programing and manipulation of resources will be tightly controlled at the central headquarters. Unit commanders will continue to have operational responsibility and commensurate authority for meeting assigned schedules.

volume of individual status changes that affect all personnel within the theater in a given reporting cycle or processing cycle would be required. The timeliness and responsiveness of data will be represented by perpetual inventory processing. This is "inventory in motion" for personnel. The objective of the data system will be to remain current with the dynamics of projecting and forecasting of the management process, as opposed to what is often simply reaction to crises. It is important that we have a data system that will enable us to solve problems before they occur. This is a goal that is important in other aspects of service-support management; but in personnel management we are dealing with human lives and it is essential that we find ways of avoiding errors and inequities that are frequent occurrences today.

In the utilization of personnel other than US military, including non-military local and third-state nationals, refugees, etc , we find an auxiliary manpower resource capability available to the theater commander. To this extent, the administration and management of such resources, in terms of elements of data required, corresponds in essence to that prescribed for military personnel administration and manpower management.

6. Construction

As discussed in paragraph 5, Section III, "Assumptions Related to Construction," the normal basis of issue for construction supplies is an approved project. When plans and project approval sufficiently anticipate needs, an ideal situation exists. In actual practice sufficient lead time is frequently not available. Insufficient lead time however undesirable is something that the engineer commander learns to live with as a "normal" frustration of military operations. Another fact concerning "construction-type" or "engineer-type" supplies is that they are used in substantial quantities on work that is not part of an approved project. These supplies are used based on "today's" needs or "tomorrow's" needs. Need for these engineer type supplies may be generated by enemy action, short-term tactical plans and operations, weather (rain, snow, wind, sudden temperature changes) and other natural causes such as flooding or drought. An adequate logistic system will include means to satisfy the constantly changing requirements for engineer type supplies.

SECTION V
MANAGEMENT CONTROL

1. General Description of the Command and Control System

As mentioned in the previous section, the command and control system visualized by the ad hoc working group will depend on the availability of a "total data base" that is duplicated on a real-time basis in both CONUS and the theater. Such a system will have application in all intensities of warfare. The flexibility provided by the duplication of data in two or more locations, and by the timeliness of data afforded by continuous updating through broad-band communications and immediate access, will make the system effective whether we are fighting brush-fire wars, major conventional wars, or full-scale nuclear wars.

The system relies on effective planning and programing. These plans and programs, fully incorporated into the computer system, quantify resource requirements with respect to time. Data will be collected from operations and automatically analyzed to meet any requirements for management information posed by the commander. Some of the requirements will entail continuous, automatic analysis. For example, a comparison of operations with plans and programs may be continuously performed by the computer, with discrepancies that reach a predetermined level of importance automatically displayed for the commander. To the extent practicable, the computer will perform all analysis functions, leaving only a decision among alternatives to the commander. Decisions made by the commander are immediately reflected in plans and programs and in operating instructions for subordinate commanders.

The system should have the capability of evaluating enunciated policies or indicating that policies are required. This system should tell the commander how well he is doing his job, how well his orders are being carried out, and how effectively he is supporting the tactical commanders.

2. Approach to Measurement of Management Effectiveness

Program accomplishment was considered one of the most important measurements of effectiveness. It is particularly beneficial to the logistics commander to insure that events are proceeding as planned. It is envisioned that this would be accomplished by some type of continuous, time-phased approach. This technique could highlight deficiencies or deviations within the system as they occur or are anticipated to occur; or it could compare the actual status with the program. Probably both techniques would be used.

It is recognized that there will be changes to the program. Thus, another indicator identified is the frequency (or degree) of changes to the established program. Frequent changes or changes of great significance could, for example, point to an unattainable logistics policy that places a burden upon the system. (Consistency checks may provide similar indications of discrepancies.) It is useless to establish policies, plans, or programs that, due to the vagaries of warfare, cannot be adhered to. On the other hand, changes to programs could be the result of weaknesses or deficiencies found lower in the system. In either case, as changes occur the cause may be traced and corrective actions taken.

Another measurement, and probably the most important, is the reaction of the tactical commander to the support he receives. This is probably the hardest measurement to make. A current technique is the staff visit to the field where staff officers go to the tactical units and question them about the adequacy of support. Though such a system will no doubt still be in existence in 1990, better (perhaps automatic) evaluation techniques are required.

The last indicator is the efficiency of reaction of the system to requirements placed on it. It is necessary for the support commander to, first, determine that his directions are being followed, and second, to evaluate their accomplishment. Today many commanders issue instructions and have no means of following up. Deficiencies that occur today seem to persist. An approach to following up instructions is to insure that all orders issued by the commander are reflected in changes to the program, if necessary. Then, feedback from operations is automatically compared with the program, indicating the effects of the corrective actions.

To summarize, the group named five major measures of effectiveness: accomplishments (and their projections) versus programs, frequency or degree of changes to the program, evaluation of logistics policies, approval of the tactical commander, and the efficiency of reaction of subordinates to the service-support commander's orders.

3. Application of Measures of Effectiveness to Transportation Management

To illustrate paragraph 2 consider some applications to transportation. The transportation management system must have automatic warnings built into it of potential short falls as well as actual short falls. Impending danger points must be flashed to the commander so he can take action.

The manager at theater level must know, on a real-time basis, the status of the transportation system, to include all modes (air, rail, water, motor), terminals, transfer points, shippers, and consignees. Effects of weather conditions should be predicted as far in advance of the conditions as possible. The transportation system has a rated capacity that is affected by three things: changes in requirements for movement, changes in the capacity of the transport modes, and changes in the receiving and shipping capabilities of the terminals, transfer points, shippers, and consignees.

A theater transportation system is managed by means of a "movements program," a command directive that determines how much has to be moved, when, from where to where, and by what means. Any change in the transportation system capacity affects the program. The effects may be immediate (e.g., the rail line is closed for 36 hours and unit A is not going to get its supplies tomorrow) or long term (e.g., the system will have a reduced capacity for the next 3 months and we much change the flow of supplies and the long range movement program).

Some specific measures of management effectiveness are:

- Rate of ship unloading, port clearance, retrograde loading, versus the norms set for these operations in the original data base.
- Percent of deliveries being made against required delivery dates.
- The age of materiel movement requests (has cargo been awaiting port clearance for movement from a shipping point for over 3 days, 10 days, etc.).
- The extent that movements were made against the program; and, collaterally, how many movements were made outside the program.
- How many shipments were in route at any given time.

4. Summary Description of the Management Control System

The combat-service-support management control system envisioned incorporates the logistics policies, plans, and programs for the theater in a PERT-type network approach. Alongside these data are the logistics-system capabilities represented principally by TOE units. It is thus possible at a given point in time to correlate logistics requirements with logistics-system capabilities. Periodically a check can be made to determine that logistics support is compatible with the policies,

plans, and programs. This is the level of management control deemed appropriate for the theater commander. Subordinate management systems will exist for the functional areas of logistics, such as supply, maintenance, and movement; and these may be tied to the theater service-support management control system. The theater commander will rely primarily on his top-level control system; but, nevertheless, he will be able to probe at will into the functional-operations management systems for in-depth studies.

SECTION VI

CONCLUSIONS

1. The types of data that will be required in 1990 for management of combat service support are the same as those required today. The functions of support will not change. The response time available for data analysis, however, will radically decrease because of increased mobility and dispersed battle units.

2. The major data requirement is for resource visibility while in transit, in storage, and in use. This visibility includes knowledge of type, condition, and availability of items, and predicted demands.

3. The system must be self-checking to assure the highest possible confidence in the validity of data and self-correcting where risks are not high.

4. The timeliness of data must be the maximum that the state of the art will support.

5. Data and information should be displayed visually, and a hard copy capability should be available if needed.

6. All data users should have access to the data required, subject to need to know limitations based on jurisdictional lines or as deemed necessary by commanders. Two kinds of limitations should be exercised: authorization to inspect data and authorization to modify data.

7. To obtain full utilization of data made available by the system, all users must be trained in the use of the data gathering and display system. Training programs should be developed well in advance of equipment when it is fielded.

8. It is possible and desirable that logistics policies, plans, and programs be developed for a specific theater and entered into the automated management information system simultaneously in CONUS and the theater of operations. Through consideration of the units in a theater, or in transit to a theater, along with logistics policies, plans, and programs, it is possible to correlate theater capabilities for combat service support to policies, plans, and programs.

9. It is possible through use of automatic data processing to apply measures of effectiveness to logistics policies, plans, and programs, to correlate theater capabilities for combat service support to policies, plans, and programs.

10. Dedicated automatic data processing equipment and communications are required for rapid transmission of data and correlation of dispersed operations.

11. A computer model of the total combat service support system in the theater should be available and should include a simulation capability. With all resources included as variables in the model, effectiveness could be measured automatically. Corrective action could be simulated by the model before they are applied to the real world.

12. The manpower-management data-control process must provide relevant management information based on a statistical foundation for decision making.

13. Maximum efforts must be made to eliminate or minimize the redundancy of data collected at various echelons.

14. Data collection processes must incorporate comparisons, trend evaluations, indices, pattern identification, indicators, and identification of excursions.

15. Software technology is likely to be more limiting than hardware technology.

APPENDIX A

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APPENDIX B

SUMMARY OF PRESENTATIONS

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WELCOMING REMARKS OF
COL GEORGE A. NABORS
COMMANDING OFFICER
U.S. ARMY ADVANCED MATERIEL CONCEPTS AGENCY

As you can appreciate, we cannot hope to accomplish the Agency's mission by relying solely on the relatively few people in the organization. Actually, one of our key objectives is to establish ourselves as a focal point for the creative capabilities that exist through the Army. Then, by adding the ideas contributed by other services, industry, and educational institutions, and by synthesizing these ideas within our specialized frame of reference -- the Army 20 years in the future -- we become more of a catalyst than a creater.

I would like to say just a few words about the study to which this ad hoc working group will contribute. Service support has not kept pace with technological progress in other military areas. Consider, for example, the highly sophisticated command and control capabilities existing, or under development, for tactical commanders. Then compare these with the comparatively unsophisticated logistics control centers serving field-army and theater commanders. Yet, the problems of coordination, control, and interfacing that we find in service support are so complex that they are difficult even to conceptualize.

We feel that we can make a major contribution to future planning in the field of service support. We have selected the project on which you will work today for two reasons. First, with major improvements now visualized for mobility, there are compelling reasons for providing managers with the capability for rapid response to volatile environments. Second, the study of service-support management from the point of view of the commander of the Army in the field affords us an overview, in a systems context, of many of the problems of service support.

So, we expect this overall study to be doubly useful. After a number of ad hoc working groups and their associated analyses, this program will culminate in the conceptual design of a transportable command-and-control center that will utilize (or at least consider the use of) the most advanced potential devices for storage, analysis, and display of management information. And, simultaneously, the study will provide us with the framework on which we will structure other studies of service-support materiel concepts. With this "systems" approach, we will have some assurance that we are applying our resources at the most critical points in the system, and that the components of the system which we design will be properly supported by the balance of the system.

PRESENTATION OF
Mr. Joseph C. Smith

Technical Adviser, USACDC Supply Agency

SUPPLY MANAGEMENT FOR A FUTURE THEATER OF OPERATIONS

Before we consider the specifics for management control in the 1990's we must take a look at the environment in which the management controls must operate. There are three major discernable trends that will influence or impact on management controls within the military. I will discuss each of these as separate topics realizing that they, in fact, interrelate.

First, there will be a reduction in or elimination of US offshore bases with increased emphasis on strategic mobility. This action has already started. It is caused both by nationalism on the part of foreign nations and by the US public opinion that we are over-extended and need to reduce military expenditures. We see today such actions taking place in Libya, in the Philippines and in Okinawa. Our bases in Spain may be tenuous. Our alternative is to increase our capability for strategic mobility. This is coming through large logistic aircraft both military and civilian, containerships with reduced turn-around time, and proposals for the Fast Deployment Logistic Ship and other approaches. By the 1990's we must not count on oversea bases. The implications for management control are significant, and alternative approaches must be considered. Some alternatives are these:

- Provide management control from CONUS for an oversea theater.

  The Bishop Report, Responsive Automated Material Management System (RAMMS) of November, 1962, developed such a concept. The US Air Force operates such a system for a group of their commodities totaling about 70,000 lines. By the 1990's, satellites, microwave systems, and coaxial cables will be the key elements in the communications network. A single communications satellite hovering 22,300 miles above the equator can pick up a microwave beam from any transmitter in its "view" which covers a third of the globe, and relay the signal to a receiver anywhere in this area. Communications satellites with capacities equivalent to at least 60,000 telephone circuits are likely. A new

three-foot ground terminal has been designed to provide voice, television, and teletype communications through synchronous-orbiting satellites. The portable antenna and ground station, which folds into shoulder packs, can be carried by two men. Thus, management control, thousands of miles away from the point of control, will be technologically feasible in the 1990's. Congress has been concerned over lack of asset visibility or knowledge of materiel stocks and status on the part of the military. National inventory control points in CONUS must receive a feedback of demand or usage data as a basis for procurement. Available materiel assets must be controlled on a priority basis if the most important needs are to be met. There is and will be much argument for the exercise of management control exercised in CONUS for a theater of operations. We envisage a theater-oriented Logistics Control Office in CONUS that would exercise this management control in conjunction with the NICP's of the Defense Supply Agency, Army Materiel Command, and General Services Administration.

- Provide portable and mobile ADP centers for the theater of operations.

  Although management control would be exercised in CONUS for a theater, we do not envision that the theater would be devoid of ADP. We do see a requirement for ADP within the theater for the continuation of the management control exercised in CONUS. An example of this monitorship of management control would be the relaying of data from the Logistics Control Office in CONUS to the theater logistics ADP center on supply shipments that are leaving CONUS for the theater. The theater logistics ADP center could assimilate such information and break it down into work schedules and in-theater transportation requirements. The portable and/or mobile ADP centers may be placed aboard ship, placed in submarines, or provided in the form of vans. Again, technological advances are working for us. We can anticipate a significant improvement in computers and peripheral gear between now and the 1990's. The trends in hardware development are indicative as follows:

  - The storage section of one average-sized model of the early 1950's filled 153 cubic feet. Now the same amount of information can be squeezed into 3.3 cubic feet. New developments in circuitry are expected to reduce this to less than one cubic foot by the 1980's.

- The 1967 computer was ten times smaller and 100 times lighter than the 1953 machine.

- Computer costs are getting cheaper. In 1957 it cost $130 a month to lease a computer with enough capacity to store one-million characters. The same storage in 1967 costs $8.75 a month to rent.

- Microfilm and computers are already being used in conjunction, affording users with the means to visually analyze computer data and to reproduce portions that they require in hard copy. One such system now in use eliminated more than 50-million pages of printed paper and has provided world-wide distribution of supply data on a current basis.

We envisage the use of small portable computers within a theater of operations tied to input/output devices and supporting microfilm viewing devices for internal theater management control as well as interfacing with the theater-oriented Logistics Control Office in CONUS to provide a single system from CONUS to the consumer.

The second trend is that future wars will be limited in size and scope but not necessarily intensity. A visualization of the battlefield is of great importance to the logistician. The type of warfare to be or being fought dictates the quantity and types of materiel, the availability and reliability of lines of communications and the placement of logistics facilities to mention a few of the factors. Perhaps a good unclassified description has been provided by Major General Robert H. York in an article in the August 1967 Army Digest; I quote an extract from his article:

> Many future combat operations will be semi-independent actions by relatively small, highly mobile units. With the advent of airmobile units, the commander is no longer constrained by terrain and man-made barriers. The only remaining tactical constraint on the commander is that he must not outrun his logistic support. The logistic system should strive to minimize this constraint in order to maximize tactical freedom. This concept of warfare suggests a review of the Army's traditional concept of support. In those situations where a contiguous front line does not exist and the conditions within the battle area are extremely

> fluid, it is not feasible to organize support echelons laterally and in depth. The supporting system will have to be more flexible and capable of quickly responding to the individual needs of widely dispersed, rapidly moving combat elements. Either resupply must be virtually guaranteed, or emergency supplies will have to be carried if supply is temporarily interrupted.
>
> Combat elements preferably should be relieved of all support responsibility. The unit must be capable of performing the essential services that cannot be provided from outside sources. This implies that forward logistic elements that accompany the combat units must possess the same degree of mobility as the unit supported. Rear logistics support elements will have to be away from the main battle area and sufficiently unattractive as nuclear targets to minimize their chances of being attacked. The possibility of the area between front and rear becoming a no-man's land suggests the need for special transportation to bridge this gap routinely. Therefore, the support system must have immediately available, dedicated surface and air transport. With the decentralization of combat operations, retail logistics support will probably also have to be decentralized. This implies a need for a dedicated communications network for command and control. Past concepts of support by individual commodity and service will have to yield to a retail system geared to provide for the units' readiness requirements. At the wholesale level, however, commodity and service specialization is probably still required.

We can envisage for the 1990's smaller tactical units with increased capability for target acquisition, increased firepower, and increased mobility.

The control of real estate per se is an unlikely objective. Rather than control of certain key places such as transportation hubs, communications centers, and governmental centers, the defeat

of enemy forces, and the elimination of logistic support to enemy forces are more likely objectives. The roles of air, naval, and ground forces combined to accomplish these objectives will also exist. We envisage, therefore, a logistic base or a number of logistic bases in a theater of operations which we will endeavor to make unattractive to nuclear attack. We envisage a no-man's land between the combat forces and the logistic base. We envisage an air terminal and support forces contiguous to the combat forces. The management control, as General York indicated, must be directed to unit readiness and operational requirements. The mass approach to resupply along with the echelonment of supply in depth is no longer required nor desired.

The third important trend is that there will be reduced reliance on supply stockpiles by increased emphasis on the inventory-in-motion principle and the integration of supply (Materiel), movement and maintenance functions. We might designate a major segment of theater logistics the 3-M system. In the 3-M system the logistician has materiel due in, limited on-hand stocks, a movement capability, and a maintenance capability. With these resources he must maintain unit readiness and meet operational requirements. He has a number of options available. He can throughput stocks that are enroute to meet supply needs, he can use stocks on hand either in the forward area or in the LOG BASE, he can have the item repaired, or replace it and evacuate the item or component requiring repair. In most of the options transportation is one of his considerations. We are already advanced in a number of these areas. The closed-loop support system which correlates materiel, movement, and maintenance is being applied to a limited number of intensively managed items. Recently, the Department of the Army published DA Circular 700-18 which sets forth as policy the inventory-in-motion principle and the reduction of stocks. Containerized supply shipments have been used to further the throughput shipment objective. HQ AMC has developed an approach on repair parts supply whereby DSU's would requisition directly on CONUS and their requirements would be containerized by a theater-oriented depot for throughput shipment. The Army-85 concept studies developed by the US Army CDC Institute of Advanced Studies calls for the integration of supply, transportation, and maintenance functions in a theater of operations. The Red Ball Express in support of Vietnam placed emphasis on the role of logistic air. The Logistics Doctrine Systems and Readiness Agency is currently engaged in monitoring a study on the impact of the C-5A on logistics. A Research Analysis Corporation study on peace-time utilization of large logistic aircraft revealed that it is economical to transport a large variety of commodities by air at the expected three-four cents a ton mile for the opera-

tion of the C-5A. It can be accepted that long before 1990 the inventory in motion principle will be a fact of life, that the day of the large oversea depot will have passed, and that management control will be utilized to correlate assets in motion with user requirements on an immediacy-of-need basis. The tempo for management control will increase immensely. More will be expected from the computer in the form of rapid analysis with outputs that summarize the various options available to the decision maker.

Again, technological advances are leading the way. Computers can make calculations 1000 times faster today over the 1953 machine. Computers can "talk" to each other. Today, we can have random access to computer information. Some computer men believe that within ten years it will be possible to write many programs in everyday English. Such a development will enable programmers to write instructions faster, thereby increasing their productivity and making more types of progress available. Thus, we can anticipate that even before 1990 the capability to meet the needs for an increased tempo in management control will be satisfied.

We have looked at the broad trends that will influence management controls in the 1990's. We can expect that more management controls will be exercised from the continental US for a theater of operations. We can expect the theater management controls to be highly portable for strategic deployment and that their programs will mesh and be a part of the CONUS controls. We can expect the application of inventory in motion principle, emphasis on unit readiness, and the meeting of operational requirements of highly mobile tactical operations as the basis for the operations of logistic management controls. We can envisage a greatly increased tempo in management control operations and we look for computer programs which will correlate requirements with resources and provide the decision maker with the plausible options.

I would . ke to consider some specifics.

First, by the 1990's computers may be as common as adding machines and typewriters are today. The potential application of computers into the accomplishment of tasks is tremendous. Where we have thought principally of large scale computers as a management tool for widespread operations, we must consider its applications in small scale design and with limited programs to task-type functions. These task-type computers can be tied by communications links to larger computers which use the data feed-in of the task-type computers. One of the problems that we now have in management

control is that original data fed to the computer is generated by a soldier with a stubby pencil. We have ongoing computerized projects such as COLED-V and TAERS, but officers who have been on the ground where the data originates have little faith in these projects due to their knowledge of the circumstances under which the data is developed. Task-type computers tied to electronic sensors and other devices can read labels on packages, weigh and cube items, perform inventory and issue data tasks as well as monitoring shipments in movement and feed the data into a management control computer. At the present time we are forced generally to work with historical or after-the-fact data. With task-type computers, management control could be working with real-time data. Let's consider some applications of task-type computers.

- At terminals, computers could read container labels and feed the data to a management control computer for verification of manifest data.

- Optimum transport loads could be rapidly developed by a task-type computer.

- The loading of transport modes could be reported as it is loaded.

- During surface transit the location of cargo could be reported.

- Incoming shipments to depots or storage facilities could be reported automatically as containers pass before the sensors and by manual means the storage site included, as supplies left the storage area this process could be repeated.

This is only a partial listing of possible applications of task-type computers that should prove to be more reliable data gatherers than human beings. By computer to computer data processing no time is lost in obtaining the data required by management control.

For management control a versatile, problem-solving type computer is required. This computer must select from its information the data necessary to provide the decision maker with plausible options. It must correlate data for the various functions involved to include materiel, movement, and maintenance against the requirements of the tactical forces.

The tactical forces will be employing a computer. Such a computer system is currently being developed. It presently consists of TACFIRE for automated artillery control and TOS which is the tactical operations center.

If the tactical commander can work with great rapidity using his computer, the logistician must be equally agile using his computer to demonstrate that he can or cannot support a tactical plan. The logistician must marshall his resources quickly and he must even include resources that he doesn't have on hand but are on the way. We can expect the logistician to become involved in determining support for a number of campaigns each of which may be of three-to-twenty days' duration. These basically must be considered over and above daily resupply and the maintenance of the materiel readiness of each TOE unit.

We hope that by 1990 or before, the daily resupply requirements and most of the materiel readiness can be predicted and the system operate routinely with the minimum of management control. We perceive a scheduled throughput supply approach for most of the commodities involved in routine resupply. Schedules of planned shipments will be furnished by the CONUS theater-oriented Logistic Control Office based upon TOE units in the theater.

We have discussed in the CDC Supply Agency the development of unit authorization lists which would cover all of a TOE unit's need for materiel and supply based upon normal day-to-day requirements. It's the fluctuations in requirements, dictated principally by combat, that would be the area of concern in supporting campaigns. Also, the timing in providing the supply becomes important since we must avoid burdening the forward units with supplies which could impede their mobility. I believe that we can see the blend that must be achieved in the logistic management control with the requirements of tactics, and the computers will help make this proper blending attainable.

In addition to computers, we must have a communications system that will make the computers effective. We have mentioned that satellite and microwave communications will be required. We mentioned that a single communications satellite 22,300 miles in the air can cover one-third of the globe. We may also need communications satellites which are only 100 miles in the air for use within the theater. We also foresee the need for microwave communications. We have had a problem in communications channels - we clutter up the airwaves. Since microwave communications transmit in billions of cycles a second, they provide tremendous bandwidth. We would like to be able to anticipate a laser communications system by 1990, but scientists advise that a technological breakthrough which is not foreseen is required.

Our hardware picture looks good. Task-type computers are now being used to control production machines, assembly lines, and for numerous other uses. Our requirement is to determine the specific tasks that we want such computers and their peripheral gear to perform.

Management-control-type computers are available today. The hardware is probably ahead of the software.

Satellite communications exist and will be improved upon and become more numerous.

Microwave communications exist and are being applied; an example being the Republic of Korea military forces.

We have had an old maxim - the right supplies, at the right place, at the right time, and in the right quantity. This is still the objective of supply management. The new tools which we foresee should bring this objective closer to realization.

PRESENTATION OF
Mr. Johannes Vrugtman

USACDC Transportation Agency

POST 1990 TRANSPORTATION MANAGEMENT DATA REQUIREMENTS

SUMMARY

Determination of theater-level transportation management data requirements in the post 1990 period requires visualization of transportation operations and the theater transportation function in that time frame. All modes of transport available today will still be in use in the 1990's. A larger proportion of theater cargo requirements will be carried by air, but sealift will continue to carry the bulk of military inter-theater cargo. Cargo not moved by roll-on/roll-off means will be containerized; personnel will move by air. A prime feature of post 1990 transportation will be inter-modal standardization; cargo will flow directly from one mode of transport to another without reconfiguration and redocumentation.

The transportation function in theaters of operations consists, for practical purposes, of the operation of transport modes and terminals, and movements management. Movements management is the process of planning, programming, coordinating, and supervising the allocation and use of the available movement capability. Movement capability is the ability of shipping and receiving agencies to load and unload, and of the transport operators to move men and materials at a desired rate in the short and long run. Movements management will be exercised at the highest practicable level as transportation requirements usually exceed capabilities and equitable allocation of available resources requires command control.

The movements management authority will be centralized at theater level and will have a combined and/or joint staff. The movements management authority will set priorities and allc ::e transportation resources, and will control movements with the aid of a central data processing system capable of providing transportation system status information on a real-time basis. Indicators of management effectiveness, not all of which are needed on a real-time basis include:

- Capacity of the transportation net to include terminals, transport modes, shippers, and consignees, both current and anticipated.

- Tonnages and numbers of persons enroute to and within the theater and scheduled for movement.

- Transportation system status, such as percent of capacity utilized, backlogs, and bottlenecks.

- Transportation performance such as percent deliveries by required delivery dates and tonnages handled versus rated capabilities in various segments of the system.

For those data which are needed on a real time basis a capability for both instant projection and hard copy reproduction may be required.

PRESENTATION OF
Mr. Kenneth Bopp

USACDC Personnel and Administrative Services Agency

PERSONNEL AND ADMINISTRATIVE SERVICES OF THE FUTURE

SUMMARY

The Personnel and Administrative Services Agency is the USACDC agency for Adjutant General and Finance areas of interest. These include personnel, administrative and financial management, auxiliary manpower resources management, morale services, finance services, management of certain ADP resources and graves registration activities.

In the field of personnel, administrative and financial management, the focal point is, and must continue to be, people. Therefore, the things people do, and how they are managed and served are of primary concern to this agency.

Of equal significance is the function of command and its role in attaining a marked increase in the responsiveness of these systems. In areas which affect the individual, such as personnel administration, our indicators of management effectiveness must distinguish between those elements which are essential to military discipline and those which are arbitrary and counterproductive. We must draw a finer line between the human and materiel aspects of theater resources to avoid overlooking the soldier's nature as an individual.

In our approach to this period we must explore what the role of man should be in the operational environment at the close of this century. This is fundamental to personnel systems since this definition in an overall sense will set the pattern for subsequent considerations affecting personnel in terms of the "philosophy" of command, organizational structures, and man-man or man-machine relationships. This suggests a need for a personnel forecast which will analyze the expected characteristics of man, individually and collectively, in terms of physical, psychological, sociological, educational, political and even religious factors. This should also identify the significance of such characteristics in relation to military operational objectives and provide a meaningful basis for an evaluation of the function or role of people in future conflicts.

In military personnel management, the decision-making process is central to the system at all echelons. Two types of data are required, individual historical data and cumulative statistical analyses of total manpower resources. Individual data must be retained in their edited raw form from the point of origin to its ultimate repository to promote flexibility and ease of access for statistical analysis. The volume of data and its distribution within the Army in the field will represent an inverted pyramid of data which gradually diminishes from top to bottom consistent with the delegation of authority to successively lower echelons. The timeliness of such data is relative with respect to the priority of actions involved and the point of decision. However, the total system represents a perpetual cyclical inventory of the status of individuals and an assessment of total manpower resources in terms of numbers. The relevancy of the decision-making process then becomes a function of time in relation to the availability of accurate data.

The management of the Army by financial indices may become a more specific requirement for this period, as opposed to personnel, materiel, or other commodities. However, the intensities of war, or peace, will influence the nature and degree of financial management that will be required and the level at which financial information will be incorporated into operational management in terms of programming, budgeting, and accounting.

In the related area of military pay or disbursements, individual financial data would be consolidated with personnel data and produce a perpetual inventory of individual financial accounts. This has the potential of producing a relatively cashless society which would reduce the flow of currency in-country and the problem of transferring excess personal funds. However, this should not ignore the requirement for financial data by commanders as a means to affect other types of local disbursements. The need to regulate the acquisition, conversion, and transmission of money, as dollar instruments, to, from, and within host countries represents a complexity of factors involved in currency controls. International economies and rates of monetary exchange are just two of the factors that must be considered.

In the area of health services and care of the deceased it must be recognized that advanced prophylactic and therapeutic techniques will expand definitive treatment at the time and place of the casualty incident to affect treatment or prevent deterioration pending evacuation to a medical facility. The use of aerosol tissue adhesives projects a potential to reduce the mortality rate of certain casualties.

A critical feature in the care of the deceased must consider the changing concept of death and the criteria by which such determinations are made. The measures of effectiveness in such cases are dependent on the degree of precision required in the identification, classification, and evacuation of casualties at all echelons during this period. These must be based on professional medical judgment. Of equal significance is the need for data which reflects measurable unique characteristics of individuals which will permit prompt and accurate identification of individuals. Such data is critical to all man-man and man-machine interface relations, not only for casualty evacuation, but for all personnel management functions.

The net result of these approaches to the total service-support-control-center package projects a need for a sophisticated administrative ADP-Communications network to insure the integrity and continuous operations of centralized data bases in CONUS; a family of simple, compact measuring device to record unique human characteristics which will promote increased responsiveness of personnel identification processes for both living and dead; increased emphasis on scientific research to extend life-sustaining functions of severe casualties during evacuation and the preservation of remains to facilitate rapid evacuation; and remote peripheral devices to support and promote improved disbursing and other financial services to the individual soldier in the field.

PRESENTATION OF
Mr. Athol George

US Army Logistics Management Center

MEASUREMENTS OF MANAGEMENT EFFECTIVENESS IN SUPPLY MANAGEMENT

SUMMARY

As in any logistical operation, supply management is measured first by its success in meeting the needs of those supported; secondly, and always after the fact, by the efficiency and economy of operations. It follows then that indicators for effective management must be designed with these two separate and different goals in mind.

Army Regulation 310-20 defines supply management as follows:

> "Supply Management - See Inventory Control (AR 310-20)."

> "Inventory Control - That phase of military logistics which includes managing, cataloging, requirements determination, procurement, distribution, overhaul and disposal of materiel. Synonymous with materiel management, inventory management, and supply management."

This definition is comprehensive and covers such a multitude of detailed functions as to require that the mission to be measured must be carefully defined, and will vary at every echelon of activity and in accordance with the conditions under which the operation takes place.

In view of this, the working group should first determine the various conditions under which supply management must operate: e.g., CONUS peacetime; CONUS mobilization; overseas allied territory, peacetime; overseas allied territory, wartime; and enemy territory, wartime. Having identified the varied conditions under which supply management must operate, the working group should then identify the particular requirements of each situation. Having done this, the next step would be to arrive at the combination of most complex activities to be measured. These should be of such magnitude that any less complex operation can be measured simply by selecting the appropriate elements. Having done this, the final step is to establish the

indicators of effectiveness for each combination of operations with recognition of the need for measuring immediate support, anticipating problems before they arise, and justifying the operations after the fact.

Among the things the working group should consider is a determination of the method by which supplies will be grouped for management purposes. There are a number of such groupings already in existence, each made for a particular purpose. Among them are:

a. Classes of Supplies. This divides all supply into ten classes, identified by a roman numeral, and is primarily designed for broad logistics planning purposes. These ten classes are further subdivided into a total of thirty sub-classifications; for example:

MAJOR CLASSIFICATION	SUBCLASSIFICATION
CLASS I - Subsistence	A - In-flight rations
	R - Refrigerated subsistence
	S - Non-refrigerated subsistence (less combat rations)
	C - Combat rations
CLASS II - Clothing, Individual equipment, tentage, organizational tool sets and tool kits, hand tools, administrative, housekeeping supplies and equipment.	B - Ground support materiel
	E - General supplies
	F - Clothing and textiles
	M - Weapons
	T - Industrial supplies

b. Federal Supply Groups. All supplies used by the Federal Government are divided into Federal supply groups. These groups are used by supply management at the wholesale level for identification of items, for control of procurement and production, and for other purposes. There are 76 such groups which are further subdivided into 566 classes.

c. Intensity of Management. Based primarily on either unit or total actual cost, or on relative importance, supplies are grouped as follows:

- Principal items.

- Minor secondary items and repair parts. These are further subdivided according to value of total annual demand:

Grouping	Dollar Value Gross Annual Demand
Very High	$1 million and over, $100 unit price or greater
Very High	$500,000 and over
High	$50,000 to $500,000
Medium	$5,000 to $50,000
Low	$5,000 and below

d. Source of Funds. Supplies are grouped according to the source of the funds from which procured, generally identified as PEMA items, stock fund items, and OMA items.

e. Storage Characteristics. Supplies are grouped according to storage characteristics or requirements:

- Igloo (Ammunition and Explosives)
- Refrigerated
  - Freeze
  - Chill
- Covered storage
  - Controlled humidity
  - Heated
  - Enclosed
  - Shed
  - Open storage improved
  - Secure storage unimproved

A further constraint, particularly when considering higher echelons of management, is the necessity to prescribe indicators which are gathered in the normal course of operations with the minimum additional effort on the part of the reporting agency, and which are themselves useful to the gathering and reporting agencies.

It follows, then, that supply management at the Army-in-the-field level is effective when the required materiel is available in an adequate quantity on a timely basis. Accordingly, the indicators sought should be those which point out actual or potential areas where the system is, or will become, ineffective; e.g.:

- The fact that unit has all authorized aircraft should not require special attention. If, however, 50% of those aircraft will complete "time between overhaul" within X operational days, then the ability or lack of ability to replace the deadlined craft is an indicator of supply management effectiveness.

- The knowledge that all units have their authorized load of operational rations is of interest. Of greater interest is knowledge of the steps taken to replenish the rations as consumed. Of still greater interest is timely knowledge of an actual or potential interruption to the resupply.

PRESENTATION OF
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A CONCEPT FOR COMPUTER-ASSOCIATED MANAGEMENT INFORMATION DISPLAYS

SUMMARY

The development of any management information system is dependent on the precision with which the system objectives can be stated, and to what extent the data requirements can be identified and understood. The concept developed for consideration is based on the following axioms:

- The major purpose of a display system is to enable the user to identify, detect, and recognize states of the event world and to receive feedback from the action generated by the user in the exercise of such functions.

- Environmental, task, and user factors implicit and explicit in the statement of objectives provide the base for projecting display system design.

Based on documents outlining the current technical and procedural details of Army logistics management, the following parameters can be examined to project the nature of combat support service and the requirement for computer-assisted management information displays in the 1990's:

- The nature of environmental states which affect logistics will continue to represent broad spectrum possibilities, ranging from relatively static states with stable data emission characteristics to dynamic and unstable data fluctuations.

- Improved communication links will be available to transmit logistical data. This implies that sophisticated priority in data handling procedures need to be established to isolate critical logistical data. There will be reduced delay time for data acquisition and as a consequence data loading can be expected.

- Rapid change in conduct of operations may require:

  - New methods for the human operators to identify correctly trends which are not readily apparent from the data.

- Techniques for cross-checking the reliability of highly dynamic data states will be required.

- Concepts for locating missing data from information displays and identifying processing breakdown are required.

- Time required for the individual to make the needed combat-service-support projection given the data at hand, may require a display uptake capability that is beyond the present state of the art.

- The influence of individual differences in the utilization of data for decision making may make imperative the matching of him as skills, and the creation of new ones. New skills are required by the user in perceiving data relationships and manipulating such relationships.

The present state of the art of information displays indicates the following. To what extent each are pertinent to the above factor needs to be determined:

- Displays are limited in their capacity to present amounts of data to users. Overloading and noise problems often add to programming problems.

- Displays can be the interface between man, the computer, and the event world. The relative usefulness of this capability, and under what conditions this is required, is not known.

- Display technology provides for presentation of data to individuals as well as to groups. Large control centers are possible, but their function and relevancy are not entirely clear.

- Display technology provides access of data to varying echelons of the service support function. Availability of data to echelons other than of the primary user may serve to overload him, yet he may require some referencing capability.

PRESENTATION OF
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ORGANIZATION OF DATA FOR MANAGEMENT CONTROL PURPOSES

I. Introduction.

This paper outlines a general concept for the management of data. As used herein, the term management or management control is limited to Army-in-the-field combat service support, and the term data includes all forms of information and documentation, both written and oral in either hard or soft form. A basic thrust of this ad hoc group is the projection of the 1990 state-of-the-art, specifically in terms of hardware definition and producibility. I submit for your consideration that equal in importance is the definition of the combat-service-support (CSS) data requirements in that this element is essential in the definition of the system dynamics.

This paper is submitted with the intent of providing some definition of CSS data requirements by providing a structure within which they can be systematically defined.

The present and near term capability for the collection, analysis, and display of CSS data has evolved from a collection of support, maintenance, and related data management procedures. Present manuals (TM's) describe a variety of loosely related techniques and formats. Little attempt has been made to postulate a CSS "system" with the resultant lack of direction and permissiveness evolving into the present manual approach. These individually tailored approaches have been characterized by major expenditures of resources (men, money, and materiel) without a major improvement in the capability of field commanders to manage or control service support elements effectively.

Major activities of CSS include supply, maintenance, transportation, facilities construction and operation, personnel administration, fiscal matters, care of deceased, logistic services, health services, rear-area policing and protection, detention of U.S. military personnel and prisoners of war, international logistics, and civil affairs. These activities become the basis for broadly identifying data requirements for management control.

To enhance management control, data must be collected, processed, and displayed in a manner which provides commanders and national level agencies the information which permits evaluation of:

- Support requirements
- Support resource status and readiness
- Effectiveness of support operations
- Support resource adequacy.

Specifically, the CSS data system must provide timely and accurate data for the:

- Management and control of the support effort
- Determination of support readiness and effectiveness
- Accountability of personnel and materiel status
- Satisfaction of data requirements for higher headquarters and National agencies.

2. Problems with Existing Methodologies.

A number of boards have examined the problems of combat service support and have determined that present methods are not functioning in an effective manner. Chief criticisms have included:

- Lack of an integrated CSS data system
- Present CSS data is of questionable use
- Administration of the "system" and corresponding resource requirements are excessive and detract from mission accomplishment
- Forms and formats are too numerous and complicated (not standardized)
- Insufficient feedback data
- Time required to collect, analyze, and make decisions is too lengthy.

Evidence indicates that much of the commander's valuable time is spent in administering existing methodologies with a resultant loss in direct CSS related duties. In consensus then, one must assume that existing methodologies are in need of a major overhaul.

3. Characteristics of Management.

A variety of management functions are prime responsibilities of CSS unit commanders. To accomplish these functions effectively, a commander requires accurate and current data. To accomplish them efficiently, he needs a system. To design a system, we have to know something about the commander's requirements for data in terms of his functional responsibilities.

a. Indicators of Effectiveness.

CSS unit commanders have prime responsibilities in four major areas:

- Support - including materiel, movement, maintenance, etc.
- Administration - including personnel, medical, personnel oriented logistics, fiscal, etc.
- Facilities - including construction, base development, communications, etc.
- Command and Control - including support requirements, interfaces (tactical, CONUS, other services), intra- and inter-system control, asset and resource allocation, direction and surveillance of subordinate units, feedback, etc.

How well these responsibilities are carried out and the efficiency with which available r sources are used are indicators of the effectiveness of CSS commanders. They may be useful in defining the requirements for data, as well as establishing the parameters of the CSS system.

b. The Management Process.

In examining the management process, two questions must be answered: (1) What does the manager do?, and (2) What must he know in order to do it? The first question can be answered in terms of his responsibilities defined above, and his specific management functions; i.e., establishing objectives, developing plans, assigning

work, allocating resources, evaluating progress, making decisions, and redirecting efforts as a result of changing requirements.

The second question can be answered in terms of the types of data and information required to perform each function and the activities for collecting, validating, analyzing, processing, displaying and disseminating CSS data and information.

c. Management Information.

The above provides a degree of dimension to the problem this ad hoc group is attempting to define. I have grossly defined a concept for detailing the CSS commander's needs for information and for defining the broad parameters of his information system in terms of:

- Responsibilities which are further defined in terms of specific management functions
- Data types which are further defined in terms of specific activities of the managers' system

4. Characteristics of Data.

Data is present in a variety of forms and types, at many locations, in complete and semi-complete stages. In many cases, it has been assembled for a specific use, but is adaptable to other uses. In many instances, its existence is known only to a select few.

a. Types of Data and Forms.

There are a variety of data types ranging from accounts to xylography (wood engravings); however, some of the more generic and familiar types include analyses and reviews, books and manuals, bills of materiels, cards (EAM-ADP), change notices, descriptions and identifications, diagrams, evaluations and predictions, films and photographs, graphs, instructions and techniques, lists and tables, orders, plans, charts and drawings, procedures, reports and studies, records, specifications, standards, and schedules.

These data are presented in a variety of forms and formats, including printed, bound, microfilm, etc., which is sometimes called "hard copy", and sometimes it is in machine form called "soft copy".

b. Sources of Data and Volumes.

Data is not instantaneous, meaning it usually is generated by some lower echelon of command and moves through various levels until it reaches a user level. As the data moves up the chain, it normally increases in volume because it is assembled with other related data and is usually accompanied with its recording and administrative information. Depending upon the scope of data and the depth to source, the volume can grow to monumental proportions, sometimes called the data pyramid.

c. Time Phasing and Interrelationship.

Two other dimensions of data which must be considered are time phasing and interrelationship. Specifically, as progress is made, more information, as a result of analysis or changing input, is added to a growing data base. In many cases, reference is made to existing data or it is included either in whole or in part with the new data.

5. Data Management.

Description has been provided then on the two basic elements of data management, thereby setting the gross parameters of the problem as well as a conceptual approach for the management of data.

In defining the CSS data requirements, the ad hoc group should consider specific responsibilities and functions of the CSS commander and relate them to specific data types. Definition of specific data activities are useful in determining man-machine tradeoffs and for defining total system parameters in the form of a data requirements matrix.

a. Elements of Support.

The concept to be considered here is the definition of support elements. Essentially, this is a generic breakdown of support areas, to support functions, to support elements, thus providing a family tree division of support efforts to be accomplished in order to achieve all combat support services. Having defined the support elements and efforts, the next logical step is a definition of required data management functions.

b. Support Management.

Specific support management functions related to data can be further defined in terms of major activities:

- Data Receiving

  Collection - once the requirement is defined and the associated support effort clarified, specific data relevant to that effort is collected.

  Validation - quality control checks are performed on collected data, data voids are established, and requests for additional data forwarded. In essence, all data is screened and edited before it is processed any further.

- Data Storage

  Analysis - the credibility of data sources, its completeness, accuracy and consistancy are analyzed to eliminate spurious or inaccurate data.

  Storage - refined or raw data is stored in accordance with specific program requirements.

- Data Processing

  Display - data is displayed or presented in the order and form selected by the commander.

  Dissemination - selected data is processed and formatted as required by using activities.

- Decision and Action

  The commander uses stored and processed data to make decisions which result in actions and feedback data which may result in updating the data base.

c. Support Data.

Having examined support activities and efforts and management functions and data types, there remains the need to correlate these in terms of specific CSS data requirements. Using the attached worksheets the ad hoc groups should first determine the commanders essential data requirements. This should include such management data as: analyses and reviews; evaluations and predictions; plans; procedures; reports; records and schedules.

Each of the above data types are of significant importance in providing the answers to two questions of vital interest to CSS commanders

(1) What actions are being taken, by whom and with what resources?

(2) What results are expected and when?

The answers to these two basic questions require a vast resource of data in a form suitable for performing each management function and providing the CSS commander some indication that things are happening, situations are improving or getting worse and that sufficient resources are available to accomplish his decisions.

d. Data Base Considerations.

There are of course a number of things to be considered in developing data and system requirements. Specific consideration should be given to networking all of the CSS commanders requirements (both efforts and data). This would provide a base against which accomplishments can be reported, deviations detected and actions implemented. In addition, a systems approach to the determination of requirements as described, might prove useful. Other considerations might include: a determination of how the system will be used; the resources required for its operation; a definition of demand functions; and the requirements for the maintenance of acquired data. Specifically, I think the CSS commander is looking for a system that defines:

- The requirements for all assigned missions (present or future).

- The availability of resources to implement requirements.

- The allocation of resources where demands conflict.

- The constraints or uncertain ties of particular approaches.

- The alternatives to the accomplishment of all decisions.

In addition, the system and the data which supports it should provide status summary, outlook and appraisal of required and alternative actions, automatic problem impact, and accomplishment reporting.

In summary, the background and definition of the CSS environment, the CSS commander's functions and his need for data, in short the management of the entire process, provides the basis for system

definition. The parameters of the system can only be established after the CSS data requirements are defined. To accomplish this initial step, a matrix of data types, when analyzed against CSS efforts, should provide gross definition to data requirements. This loose arrangement can be tied together using a network approach for both efforts and data, thus providing further definition to the CSS commanders data management functions.

DOCUMENTATION FILES / CSS Responsibilities/Functions	Analyses and Review	Books and Manuals	Bills of Material (EAM ADP) Cards/Tapes	Change Notices	Descriptions/Identifications	Diagrams	Evaluations and Predictions	Films and Photographs	Graphs	Instructions and Techniques	Lists/Tables	Orders	Plans, Charts, Drawings	Procedures	Reports/Studies	Records	Specifications	Standards	Schedules	Other (Specify)	Other (Specify)	

Fig. B-7-1. Work sheet for identifying essential data requirements.

PRESENTATION OF
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ERROR CONTROL IN THE AUTOMATION OF SERVICE SUPPORT

SUMMARY

Background.

General Westmoreland in his address to the AUSA, 14 October 1969, pictured the "automated battlefield" of 1980. The technology of field army automation is not new, however. A noteworthy success in the application of modern data processing has been in the area of service support. Following World War II, Project MASS pointed out that the concept of a mobile field army demands a reduction of the amount of baggage with which it is encumbered. This can be accomplished by exchanging supplies-on-hand for a responsive supply system. The introduction of automatic data processing into the Seventh Army Stock Control and Inventory System was accompanied by reductions in turn-around times such as from 60 to 4 days. These substantial gains, however, cannot be credited to automation alone but rather to changes in logistic doctrine--primarily the elimination of consolidated requisitions so that the rate of supply is not governed by the slowest item. Further gains beyond four days turn-around are achievable by such measures as:

- On-line processing rather than batch processing
- Fill-or-kill doctrine
- Heavy lift helicopters
- Special package labeling and automatic handling techniques

However, the 1985-95 field army will be faced with a situation which is better described as "fluid" rather than mobile. Key innovations are likely to include:

- Exploitation of the predictive capabilities of automatic data processing
- "Inventory-in-motion" techniques

Service support will be less contingent upon demands from the recipient and more upon prediction of his needs ("force feeding").

Error Control.

The software in large scale data processing systems tends to be more concerned with prohibitions, constraints, and failure modes than with its basic design function; i.e., the system is more concerned with what it shouldn't do rather than what it should do. Error control software packages implicitly contain imbedded doctrine which may never have been endorsed by any Army doctrinal agency but which is created possibly by a housewife moonlighting as a computer programmer. Examination of actual software packages often reveals lack of balance; i.e., they may guard against errors which are unlikely and not costly while failing to afford protection against errors which may be more probable or expensive. Much of the available data are in the form of anecdotes; e.g., the battle lost for want of a horseshoe nail. Design of software packages primarily to avoid occasional embarrassment is unwarranted.

Types of errors in automated stock control and inventory systems include the following:

Human Errors	Machine Errors	System Errors
Input mistakes	Filing errors	Loopholes
Deliberate errors	Tape errors	Associated errors
Programming errors	Control errors	Accounting errors
Improper identification		

Although technology and system design offer opportunities to cope with machine and system errors, the human errors are a category requiring special attention. The use of interactive displays is likely to be a key factor in the solution of this problem.

PRESENTATION OF
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US Army Advanced Materiel Concepts Agency

COMPUTERS OF 1990

SUMMARY

1. Description of Computer Systems. A computer is a system composed of:

a. Processor with memory, arithmetic unit, switching gear.

b. Main Storage devices, usually a combination. Examples are of two categories: those having moving parts such as drum, disc, tape unit, and data cell, and the purely electronic or electro-optical devices such as photographic storage (real image), holographic (wave-front reconstruction), and magnetic domain tip propagation and magnetic bubbles.

c. Input Devices.

(1) Immediate input: dial or touch-tone telephone, teletype, tablet (RAND-tablet or sketch pad) and voice.

(2) Intermediate input (needs one device to put the message on a carrier and another to read it from the carrier into the computer): cards, paper tape, magnetic tape, disc recordings (three discs store the college "Webster").

(3) Direct input: real-time data (as radar and telemetry enter the computers in Houston's Manned Space Flight Center).

d. Output Devices.

Audio outputs, similar to the telephone company's time announcement, are used for direct human information; audio and visual outputs are achieved by cathode-ray tubes, mechanical plotters, laser devices, and dot arrays such as the plasma panel and the liquid crystal panel. Outputs for deferred human information (and record-keeping) include impact printers (teletype, line printers), nonimpact printers (Xerographic and photographic); and for storage alone microfilms and the Ampex "terabit memory." For use by other machines and devices,

there are "real-time outputs" such as radar pointing data or rocket destruct commands, and data reports to other computers in computer networks.

e. Switching Gear.

There is a complex data flow in the computer system. The switching gear, also called memory-bus, direct access channel, multiplexer channel, etc., steer this flow. Most of the time multiple data paths are established.

2. Forecast for Field-Usable Computer Systems of Moderate Speed.

a. Size.

The arithmetic unit will shrink in size from six cabinets (IBM 7044 or IBM 360/65) to a few cubic inches. The memory will be solid-state for size, power, cooling, and vibration reasons. Size will be below one-half cubic foot. Switching gear will be so small that 80% of the space it occupies is connectors. For the application in a military computer utility its size will be a few cubic inches. The technique to achieve this reduction in size is large-scale integration (LSI).

b. Performance.

The arithmetic unit will be only little faster than now because the emphasis is not on speed; the same is true for the memory and the switching unit.

c. Power Consumption.

The processor will consume at the most in the hundreds of watts as compared to 100KW for today's machines. Very low power consumption and extremely small size are the main goals in the development of the 1990 Army computer system electronics.

d. Mass Storage Devices.

Those with moving parts will be largely replaced. Most promising are holographic devices and magnetic bubble-based subsystems. Both achieve enormous data densities. The size for a read-only holographic memory is well under one cubic foot; a read/write device will be many times larger. The power consumption will be a few watts.

e. Input Devices.

A service support computer will use the telephone, voice (with reservations), keyboard, and real-time. This selection avoids mechanical devices. All input must be fed back to the operator for double checking. The input devices will not substantially change from today's size, power consumption, and performance.

f. Output Devices.

Again subsystems with moving parts are avoided as far as possible. All telephone inputs have a voice output capability for feedback. Its user may take notes but there will be a terminal close by with a limited print capability. Where display panels are used there is usually also a computer with mass storage so the user of the terminal will not have to take notes. If a print is required, it can be made by a dry silver or photochromic process. Microfilm printers are at the equivalent of an Army corps, line printer at theater headquarters. The small printer will be about legal page size and one inch thick with about 50W power consumption when used.

g. Switching Gear.

This is a well developed field. Today's systems use a hierarchical arrangement due to the considerable price increase for an increase in speed. By 1990 this will probably no longer be true in the speed range considered, so instead of the hierarchical connections we will have crossbars.

3. Forecast for the Capability of a 1990 Combat Service Support Computer Network.

The network gives you faster data exchange than possible today. Each terminal except at the lowest level has a display with computer and a large storage; the user does much of his work without referring back to higher or equal echelons. He does not do "paperwork" anymore. These data are automatically summarized and forwarded to his neighbors and superiors.

It is certainly feasible to monitor the path of every item in the flow of materiel and have it in the computer memories, but it is expensive and possibly not worth the expense.

Automatic reading of machine and hand-printed matter is to some degree possible today; reading of longhand may be possible in 1990.

Automatic classification [illegible] [illegible] by video picture analysis (e.g. for automatic traffic control) will be possible but again the cost may outweigh the benefit. This last remark may well be true for some processes presently considered for automation. On the other hand, there certainly are many processes easy to automate which nobody has thought of. I wish you good luck to find a few. And don't worry about the future: the computer with a push button inscribed "brainstorming" is far in the future. Mathematical deduction has been demonstrated (the Pappus-theorem for isosceles triangles), but not induction (to obtain the differential equation for the set of all conic sections).

PRESENTATION OF
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CONCEPTS FOR PERSONNEL MANAGEMENT SYSTEMS

SUMMARY

The challange of personnel management systems is to anticipate situations that will arise in the field. Frequently, the objectives of personnel systems are frustrated by seemingly arbitrary actions taken by field commanders in shuffling personnel assignments when the personnel reach the field. Supply personnel are assigned as truck drivers. Cooks become infantrymen. Then commanders blame the system for failing to supply needed specialists.

Often the actions taken by commanders, however, represent their reactions to a system that does not keep pace with changing conditions. To be responsive, the system must provide for continuous real-time updating of files so that supplies of personnel moving through the pipeline can be adjusted and manipulated to best meet the critical needs of the commander. This requires anticipation of changing needs, and system flexibility, with provision for full visibility of personnel assets both to agencies in CONUS and to commanders in the field.

Advances in computers and communications give promise of providing the hardware support necessary to achieve the objectives of a responsive personnel system. Vast random-access data-storage capabilities will be commonplace. Core memories on the order of 10^9 bytes will be available to handle personnel problems. Cycle times in the hundreds of nanoseconds will reduce processing times. There are many other examples of technological advances that give promise of supporting the needs of the described personnel system.

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13. ABSTRACT

The US Army Advanced Materiel Concepts Agency (AMCA) convened an ad hoc working group (AHWG) for three days (27-29 January 1970) to identify information-system requirements for a combat-service-support management control center for the 1990's. This AHWG contributed to an ongoing study that will culminate in the conceptual design of a transportable control center for theater-level management of combat service support. The AHWG developed a generalized description of the combat-service-support system for the 1990's. The group assumed that there would be no equipment constraints in the 1990's to collection, storage, retrieval, and analysis of vast quantities of data. The group agreed that the theater commander must be given the capability of probing into data to any depth he might desire, but that the major command-and-control needs of the commander could be satisfied by display of evaluations of logistics policies, plans versus operations, and indicators of operational effectiveness. The major information requirement is to provide resource visibility; the information system must be self-checking, and, when feasible, self-correcting; policies, plans, and programs should be entered into the automated information system (duplicated in CONUS and the theater), updated as situations change, and continuously compared with ongoing operations; and the information system should include a computer model of the combat-service-support system, providing a simulation capability.

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	ROLE	WT	ROLE	WT	ROLE	WT
Management Information Systems						
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Management Engineering						
Combat Information Centers						
Information Analysis Centers						
Centralized Control						
Command and Control						
Supervisory Control						
Decision Making						
Management Planning						
Measures of Effectiveness						

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